Ontario
Ministry of Agriculture and Food

ORDER NO. 91-015
MAY 1991
AGDEX 257
10

Factsheet

AIR POLLUTION INJURY ON POTATOES

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INTRODUCTION

Potato plants can be injured when exposed to high concentrations of various air pollutants. Air pollution injury was noticed on potatoes in Ontario in the mid-1960's. Black flecking or pepper-like spots were noticed on the underside of leaves and sometimes on the top. Injury can range from visible markings on the foliage to complete kill of the plant. Growth and yield can also be reduced from exposure to air pollutants. Development and severity of injury depends on a number of factors. These include concentration of the pollutants, environmental conditions, stage of development of the plant, varietal susceptibility and overall health of the plants.

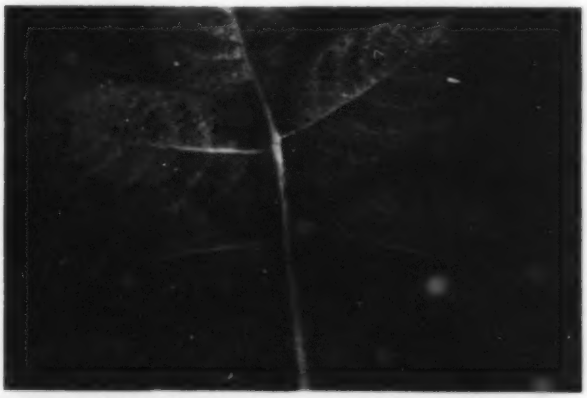

Figure 1. Black-flecking or pepper spotting on the potato foliage as commonly noticed since the mid-1960's. *Hamilton, Ontario.*

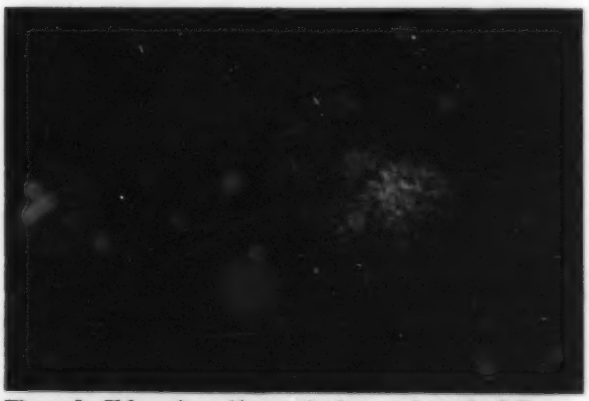

Figure 2. Chlorosis and interveinal necrosis on the foliage of Atlantic after exposure to air pollutants. *Shrigley, Ontario.*

The following combinations of environmental conditions are conducive to a build-up of injurious levels of pollutants.

1. Atmospheric ozone levels over 80 ppb for four or five consecutive hours, or 70 ppb for a day or two are usually sufficient to injure exposed foliage at a susceptible stage of growth.
2. High levels of automobile exhausts. Crop injury is often visible on fields in close proximity to the #400 highway after heavy weekend traffic.
3. Humid conditions with cloudy, hazy overcast days and little breeze leads to a high concentration of pollutants at ground level and in hollows. High pollution indexes in Toronto and Hamilton are a good indication that this is occurring.
4. Foggy conditions and heavy dews often contribute.

When atmospheric conditions for injury exist definite symptoms on the potato foliage may not always be evident, but the crop may take on a slightly yellow tinge and mature faster than expected.

Figure 3. Early senescence of a susceptible variety (Yukon Gold); showing field of potato plants after exposure to air pollutants. *Primrose, Ontario.*

The stage of development of the potato plant is also an important factor in its susceptibility to air pollution. The potato crop is unlikely to show damage in the vegetative stage, but is quite susceptible in the tuber bulking stage. Stress to the potato plant whether from heavy tuber bulking, lack of nutrition, insufficient moisture, or disease predisposes the plant to injury from high levels of air pollutant. Plants subjected to stress at tuber set may mature existing tubers and cease bulking. Yield losses depend on the potato growth stage.

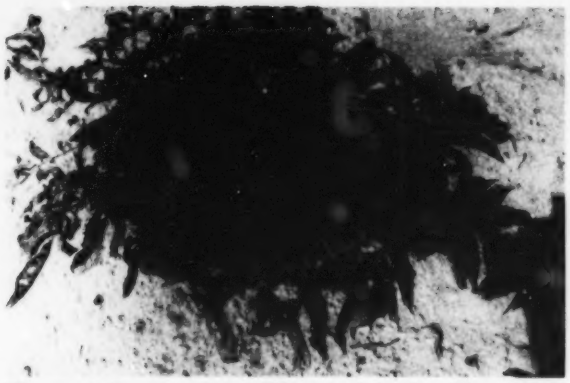

Figure 4. Severe edge killing and leaf rolling (note immature plant on right is not susceptible). *Cochrane, Ontario*

Varietal susceptibility mainly to ozone is another key factor as to whether injury will occur. Some varieties are genetically more susceptible to ozone than others, i.e., Norland is rarely grown in southern Ontario any more for this reason. Other varieties that have shown levels of susceptibility are Jemseg, Yukon Gold, Atlantic and Shepody. See rating chart compiled by Dr. A. McKeown at the Simcoe Horticultural Station.

MAIN POTATO CULTIVARS GROWN IN ONTARIO AIR POLLUTANT SUSCEPTIBILITY

Cultivar*	Relative Susceptibility**
Processing	
Atlantic	1.5
Kennebec	1.0
Monona	2.0
Norchip	2.0
Shepody	3.0
Superior	1.5
Fresh	
Chieftain	2.5
Conestoga	2.0
Jemseg	2.5
Norland	5.0
Yukon Gold	3.5

**Some cultivars included under process are used for fresh market.*

***Rating of 1-5; 1 = "resistant" (no symptoms); 5 = severe.*

Note Norland can be used as an indicator for ozone since it is very sensitive.

Figure 5. Severe burning of foliage on Atlantic. *Beeton, Ontario*

Figure 6. Sudden kill of Superior after exposure to combinations of air pollutants. *Kearney, Ontario*

Figure 7. Top rossetting and leaf curling typical of air pollution damage of Shepody. *Honeywood, Ontario*

Figure 8. Symptoms of acid rain on Trent a more susceptible variety to acid rain. *Trout Creek*

Photochemical oxidant air pollutants may cause premature aging or death of the plant, beginning as a yellowing or bronzing and early death of the lower leaves. Symptoms resemble those of senescence and poor nutrition. Vegetation injury resulting from a build-up of oxidants in the air can occur over a large geographical region. For example on August 11 and 12, 1990 exposures on the weekend caused foliage damage on potatoes from Shelburne to Kapuskasing.

Ozone, the major component of oxidants is formed by the action of sunlight on products of fuel combustion and can be moved to nearby growing areas by wind. Symptoms vary depending on the concentration of ozone in the air and the length of exposure, as stated before. Ozone injury occurs on the most recently emerged leaves. Typical ozone injury may not be evident on leaves exposed to a mixture of pollutants. Symptoms differ in different areas of the province.

Figure 9. Potato foliage with flecking "pepper spotting" injury typical of ozone injury. *Huntsville, Ontario*

Potato leaves are relatively resistant to injury by sulphur dioxides. However, exposure to high levels of sulphur dioxides will result in light tan to white necrotic areas and yields may be reduced. Symptoms on nearby sensitive plants such as alfalfa, soybean, ragweed, and smartweed helps in confirming a diagnosis. Sources of sulphur dioxides are emissions from coal burning power plants, smelters and from the burning of petroleum.

Loses in sensitive cultivars may be severe following exposure early in the season.

Figure 10. Sulphur Dioxide injury is reddish brown between veins of smartweed of Ladies Thumb. *Blezard Valley, Ontario*

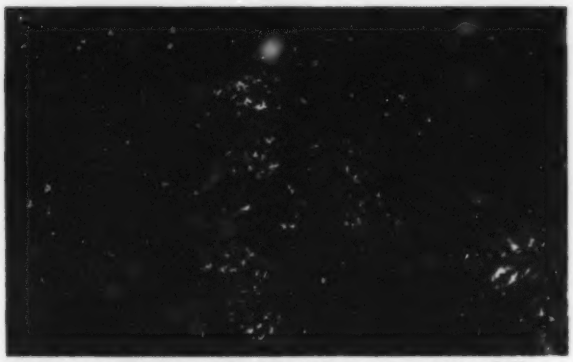

Figure 11. Sulphur Dioxide injury on potato foliage. Note: white or bleached dead tissue. *Blezard Valley, Ontario*

Figure 12. Injury to susceptible variety on left is severe following exposure to air pollution late August. Resistant variety to the right has been chemically top-killed. *Hornings Mills, Ontario*

Figure 13. Potato plant recovering from early exposure to air pollution. *Trout Creek, Ontario*

Figure 14. Injury typical of Peroxyacetyl Nitrate (PAN) creates a glazy bronzing on the underside of newly expanded potato leaves. *Alliston, Ontario*

Figure 15. Injury from air pollution can also be expressed by the plant in the form of bronzing. *Powasson, Ontario*

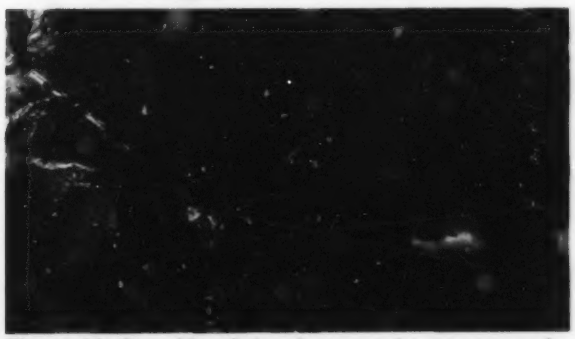

Figure 16. One side of the plant may be more severely affected than the other side. Note the interveinal darkening of the foliage on the left side of the plant. *Enghehart, Ontario*

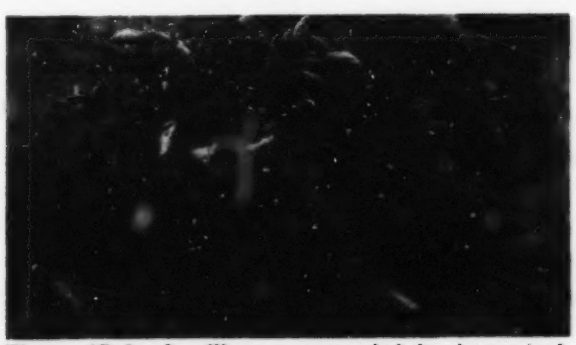

Figure 17. Leaf rolling accompanied by interveinal necrosis is often the result of exposure to air pollutants. *Moonbeam, Ontario*

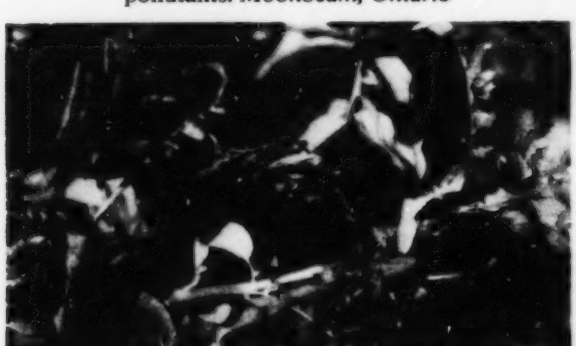

Figure 18. Affected areas of the plant often dry out and die within days of exposure. *North Bay, Ontario*

To help assist in the diagnosis of air pollution damage the following photos have been included.

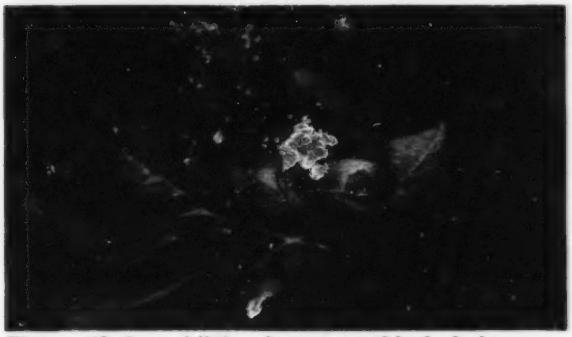

Figure 19. Late blight: brown or black lesions on foliage often surrounded by a pale yellow margin. Fluffy spores surrounding lesion may be found on underside of leaf while the dew is still present.

Figure 20. Early blight: brown necrotic spots formed from concentric rings similar to a target.

Figure 21. Lightning injury usually appears in the field as a circular or elliptical area of injured plants. Tubers at centre of charge will be cooked.

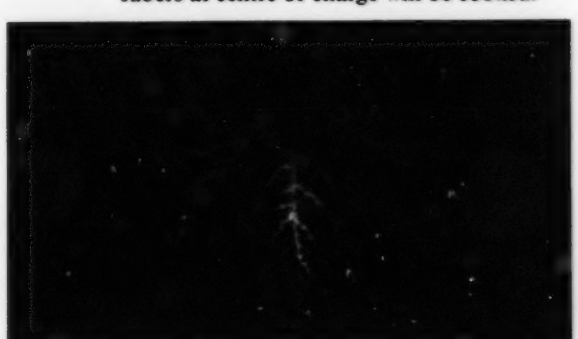

Figure 22. Veinal chlorosis symptom caused by the herbicide metribuzin.

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ISSN 0225 7882